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Healthy Mothers, Healthy Children: Does Mothers' Demand for Antenatal Care Matter for Child Health in Nepal?

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1. INTRODUCTION

Despite significant reductions in child mortality rates in recent years,[1] Nepal still faces chronic malnutrition among its children and has one of the highest maternal mortality rates in the world. According to the 2003 Human Development Report, 540 mothers died per 100,000 live births during 1985 – 2001 in Nepal, which is high even for a developing country.[2] Moreover, 1 in 2 Nepalese children is light for its age and height, and 1 in 10 is short for its age (NDHS, 1996). Given that 80% of the deliveries in Nepal take place at home without any traditional, let alone professional, birth attendants (WHO, 2004), we set out to explore a plausible, yet often *empirically* unexplored, relationship between mothers' utilization of antenatal care and child health in infant and toddler years in Nepal. We ask: why don't all mothers in Nepal utilize antenatal care?[3] Does mothers' utilization of antenatal care matter for child health?

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[1] Under-five child mortality rates in Nepal have reduced from 165 in 1991 to 91 in 2001, and infant mortality rate has reduced from 97.5 in 1991 to 64.2 in 2001.

[2] The maternal mortality rate is 400 and 380 in neighboring Bangladesh and Bhutan respectively for the same period of time (HDR, 2003).

[3] Antenatal care refers to the provision of special care for women during pregnancy. Services rendered under antenatal care include, but not limited to, routine monitoring of height and weight gain, blood pressure, detection and treatment of anaemia, pre-eclapsia, and management of sexually transmitted infections (syphilis, HIV), and advise and counsel on nutrition, family planning, labor signs, danger signs, routine check-ups, and follow-up visits.

Health depends on care, and utilization of care depends on its availability, affordability, and accessibility. The provision and utilization of antenatal care, especially that provided by professionals, is a fairly contemporary development in Nepal. Around 42% of its 24 million populations live below the poverty line, 80% live in rural areas, and more than half of its adult population is illiterate (WDI, 2005).[4] In order to make the maternal and child care services[5] accessible and, perhaps, affordable, Nepal's Ministry of Health spends over 5% of GNP in health expenditures, has implemented a new health policy in 1991 and collaborated with both the domestic and the international NGOs (Pokhrel and Sauerborn, 2004).[6] Nonetheless, the maternal and child mortality rates have not reduced at the rate expected, and, more importantly, maternal health seeking behavior seems not to respond in a linear fashion to the increasing availability of health services in the community.

Care of a mother, especially when she is pregnant, and her overall health are important in order for a child to be born with and maintain good health. Social science literature, however, offers limited and/or non-robust knowledge about this proposition at

[4] The World Development Indicators (2005) reports that Nepal's per capita GDP is US$270 and its adult literacy rate of 49%.

[5] Such as family planning, essential obstetric care, essential neonatal care, comprehensive safe abortion services and skilled birth attendants.

[6] The Ministry of Health is primarily responsible for providing both curative and preventive health care through 79 hospitals located at central, regional and district levels, 178 primary health centers, 705 health posts and 3132 sub-health posts located at the community level (The Ministry of Health, 2002).

least in developing countries' perspective. In our effort to shed light to this particular line of research, we carry out a two-staged study: firstly, we conceptualize antenatal care as having a qualitative (professional, traditional antenatal care, or none) as well as a quantitative (frequency of seeking antenatal care) attribute and estimate the partial effects that mothers' *and* fathers' education maintain on her decision to seek antenatal care from professional care providers on a regular basis;[7] and secondly, we exploit the predicted values of mothers' utilization of antenatal care emanating from the first stage regressions in estimating the child heath production function.[8]

Our analysis of the Nepal Heath and Demographic Surveys data from two different samples and data points, namely 1996 and 2001, suggests that education of a father is no less important than that of a mother in order for her to seek especially professional antenatal care in Nepal. In fact, we argue that the primacy of fathers'

[7] This brings to a complementary set of explanation to epidemiological research which often looks into the health system, and its ability, or inability for that matter, to provide effective maternity care.

[8] In the process we shed some light at least in the empirical sense to a probable mechanism – seeking antenatal care — mediating the causal association between mothers' education and child health. Scholars are skeptical whether the apparent correlation between mothers' education and child health captures its causal implication as well (Glewwe, 1999; Desai and Alva, 1999; Basu, 1994; Hobcraft, 1993); part of this discomfort stems from the fact that the actual casual mechanism by which mothers' education affects child health is not well understood at least in the empirical studies (Caldwell, 1979; Cleland and van Ginneken, 1988).

education vis-à-vis awareness that a mother ought to utilize antenatal care services to maintain her own health and that of her child should not be downplayed in a country like Nepal, where husbands often make most household decisions, including those relating to wives' health care while pregnant. We further find that a child remains healthy if its mother maintains good health, and has utilized antenatal care from professional health providers. Our findings thus offer important policy suggestions for improving maternal and child health in Nepal.

2. ANALYTICAL FRAMEWORK

2.1. Conceptual Model

We seek to answer two separate, yet interrelated, questions: 1) what are the determinants of mothers' utilization of antenatal care? and 2) does utilization of antenatal care help explain child nutritional status in Nepal? As much of the economic analysis of health care decisions and child health, we, following Becker (1965), assume that decisions to utilize antenatal care and child health are produced in households through the combination of purchased inputs and time. A household derives its utility from the quality (health, education etc.) and quantity of children (the number of surviving children), consumption of food, non-food items (such as, health care), and leisure, and maximizes its utility subject to the time constraints of each member, budget constraint, and restrictions imposed by the health production function.

Following Grossman (1972), who builds his model based on Becker (1965), we further assume that households derive utility from mothers' health and make investments in health by buying health services, such as antenatal care, among others. Decisions to utilize antenatal care are likely to be influenced, primarily, by the costs associated with utilization of health services, but also by education, household preferences and health technologies. The costs comes in the direct monetary costs for consultations, medication, and tests, and the indirect costs such as foregone income and costs associated with not performing normal activities (paid work, unpaid agricultural or household work, attending children), and transport costs. Whether households decide to incur these costs depends on its level of education, preferences and the technology by which health inputs are transformed into health outcomes. Although education may hold substantial

influences on household preferences and technology (education helps more effective use of health inputs).

The production of a child's health, additionally, depends on a set of child characteristics X_i, household (or parental) characteristics X_h, community characteristics X_c (e.g. urban or rural) – all of which are exogenous, and a number of choices relating to the consumption of a child M_i – which are endogenous.

$H_i = H(X_i, X_h, X_c, M_i, \varepsilon_i)$

Child characteristics include age, sex, birth-order, current health status (exposure to diseases –diarrhea, fever, or cough). Household characteristics include indicators of parental human capital (such as education, occupation, and health), culture (religion), household size (number of children under age five, number of deceased children), and proxies of household income (such as, what is the floor of the house made of, whether the household owns a radio). The community characteristics include the quality of community services and infrastructure (such as, type of water and sewerage facilities, availability of health services). The choice variables include mothers' decisions to seek antenatal care and to vaccinate the child. Finally, ε_i is a child specific stochastic component, assumed to be normally distributed, reflecting heterogeneity in individual healthiness, tastes, and unobservable factors.

2.2. Review of the Empirical Literature and the Derived Hypotheses

2.2.1. Determinants of seeking antenatal care

With a few exceptions, empirical studies generally find that educated mothers seek professional antenatal care in higher rates compared to their non-educated counterparts. Demanding and seeking antenatal care, following Caldwell (1979), are among the behavioral leverages that a mother's autonomy, which she wins with education, lets her enjoy. In particular, education helps mothers overcome the social and cultural constraints and have more autonomy, greater control of household economic resources, more freedom of movements, and also helps her make decisions relating to her health, such as seeking antenatal care.

However, the extent of autonomy vis-à-vis the decision-making power or the social status that education is assumed to bring to the life of a mother in a developing country might not hold, given the complexities inherent in its social structure. Caldwell (1986) accurately sees the necessity to bring the larger social context back in the picture for the accurate estimation of the effect that female education might hold on her social status, autonomy, or decision making power (p. 202). It should not thus appear surprising that empirical studies often find education to behave indifferently to, if not debilitate, mothers' ability to make health decisions for herself, such as seeking antenatal care in developing countries. For example, mothers' education seems to stay neutral [9] in seeking

[9] In developing countries, especially poor parents often send their daughters to school partly as a response to contemporary state policies, such as UNICEF's universal primary education, free education for girls up to high school, or food-for-education etc.

antenatal care in Kenya (Magadi, Madise, and Rodrigues, 2000). Desai and Alva (1999), moreover, argue that mothers' education is a mere proxy for her ascribed as well as achieved socio-economic status and the area of residence, and would question the robustness of the findings that educated mothers seek antenatal care in higher rates in Jordan (Obermeyer and Potter, 1991), Nepal (Matsumura and Gubhaju, 2001), and Surabaya in Indonesia (Taguchi, Kawabata, Maruo and Dewata, 2003). Following Desai and Alva (1999) women who receive education in developing countries are more likely to be born to educated parents, get married to educated, and thus relatively economically well-off, husbands, and live in urban areas where health care services are more available. Thus the effect that education holds on the utilization of antenatal care may be capturing

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Regardless of what might be the determining factors for parents to send, especially, their daughters to school, daughters in most cases become literate at large. So the quantitative measures of mothers' education should only record their level of education, and thereby leave out the qualitative aspects of education. One potential explanation when mothers' education have no effect on utilization of antenatal care might be that the perception (or the usage) of education among the recipients, in this example -- the mothers. Mothers those went to school as their parents were educated, or their parents were not educated, but wanted their kids to be educated might have different take on education than those who attended school as a response to changed school policies, or to bring food to households. Education, depending on variations in its underlying purpose of seeking, thus should have varying effects on mothers' status and autonomy, and her ability to make decisions about her own health, such as utilization of antenatal care.

the effect of unobserved family heterogeneity, income or the community attributes than that of education per se.

We expect fathers' education and presumably his awareness of the primacy of mothers' health care as the key *complement* to mothers' education in order for her to seek antenatal care on a regular basis during pregnancy. Although studies sparsely relate father-specific attributes – education is no exception – to mothers' antenatal care seeking behavior, we argue that fathers' education is no less important in explaining variability in mothers' health seeking behavior especially in South Asia, where women are, in general, the passive recipients of social roles. Education among fathers should help them realize the significance of antenatal care among other health interventions for healthy pregnancy, decide for mothers, and/or provide moral, social, and/or financial support as she utilizes antenatal care. We also expect mothers to utilize antenatal care in higher rates if she and/or other members of the households are exposed to mass media, and thereby greater dissemination of, presumably health, information.

We set out to test the following hypotheses.

Hypothesis 1. *Educated mothers are more likely to utilize antenatal care than their non-educated counterparts.*

Hypothesis 2. *Mothers are more likely to utilize antenatal care if they are exposed to media and, presumably, health information.*

Hypothesis 3. *Mothers are more likely to utilize antenatal care if their husbands are more educated.*

2.2.2. Utilization of antenatal care and child nutritional status

Does mothers' utilization of antenatal care matter for child health? The general state of knowledge seems to progress from the general query of whether mothers' utilization of antenatal care is beneficial to the magnitude of its benefits. Antenatal care, such as tetanus toxoid immunizations, prevention and treatment of anemia and infections, and detection of high risk pregnancies, is likely to help mothers remain healthy throughout pregnancy, and deliver healthy children who are less likely to contract common diseases, and thereby maintain good health. Prior studies, however, often treat utilization of antenatal care as an exogenous variable, and over or under estimate the effect that antenatal care maintains on child health (Schultz, 1984).

The non-randomness inherent in variables like mothers' decisions to utilize antenatal care (Maitra, 2004) ought to be recognized in order to identify its true effect on child health. Mothers might seek antenatal care because (a) they are reactive: responding to some exogenous health complications that are known to them but unknown or unobserved by the researchers (Schultz, 1984), or (b) they are pro-active: holding a strong preference for healthy children, they are seeking care above and beyond what is nominally required, or (c) both. Ignoring this unobserved, yet vital, health heterogeneity leads to over- or under-estimation of the effects of antenatal care on child health. Furthermore, the relationship that studies often find between antenatal care and child health might reflect the selection effect, as opposed to the treatment effect. When the professional care indicates vaccination against tetanus or utilization of modern medical facilities or technical know-how, and that provision of professional care necessitate a constant supply of modern/urban infrastructure, such as electricity and water supply,

transportation; the care of this nature is likely to be available in relatively urban communities in developing countries. Considering that modern medical facilities are situated in relatively urban areas, and that educated and relatively economically well-off households live in and get access to modern health facilities available in urban areas, this study seeks to find the sources of exogenous variations in antenatal care seeking behavior, and makes a careful attempt to estimate the *independent* effects of antenatal care on child health.[10] This leads to the following hypothesis.

Hypothesis 4. *Children seem to maintain good health in infant and toddler years if their mothers have sought professional antenatal care.*

[10] Schultz (2004) provides a fascinating account of the relationship between health programs and health outcomes. Following Schultz (2004) when households make decisions to migrate to communities where, for example, antenatal care services are prevalent or of high quality, the observed relationship that might emerge from this special sample is not likely to apply for the average antenatal care seekers.

3. DATA AND METHODS

3.1. Data

The Nepal Family Health Surveys (NFHS) provide information about fertility history, family planning, maternal and child care, and some aspects of socioeconomic attributes of the respondents in Nepal, and therefore meet most of the data requirements. NFHS makes available the detailed health histories of children age 5 and under, such as anthropometric measures, vaccination histories, disease outbreaks, etc., and mothers' antenatal care-seeking behavior for a sizeable and representative sample. Using a stratified cluster-sampling design, NFHS randomly selects and interviews a nationally representative sample of 8,429 women aged 15 and 49 who have been married at one point in their life. Our analysis includes NFHS information from as high as 3681 mothers, and 2554 children between the ages of 0 and 36 months for which anthropometric data are available in 1996 and 2001.

3.2. Construction of the Key Variables

3.2.1. Utilization of Antenatal Care

The survey asks (a) whether mothers went for antenatal check up during pregnancy or not, (b) how many months pregnant they were when deciding to seek antenatal care, (c) what type of prenatal care they sought, if they have, (d) how frequently they obtained antenatal care, and (e) where the mothers delivered their babies. We trichotomize mothers' choices of antenatal care into professional, traditional, and none. If mothers utilize antenatal care from a doctor or a trained nurse or midwife, we group these mothers vis-à-vis choices and call them "modern antenatal care users" (*ANTE_MODREN*); if mothers seek antenatal care from a village health worker, maternal and child health worker, other health professional, or traditional birth attendant, we group them as "traditional antenatal care users" (*ANTE_TRADITIONAL*). We also have created an index of antenatal care (*ANTE_INDEX*) by adding the number of different types of antenatal care services a mother might have sought during pregnancy. Finally, the survey provides a count of times a mother went to see antenatal care providers (*ANTE_COUNT*).

3.2.2. Child Health

The health status (weight for age, hereafter *WA*) of children aged 0 – 36 months in Nepal is calculated from:

$$WA_i = \frac{X_{it} - X_{Mt}}{\sigma_{Mt}}$$

where X_{it} is the weight of the i^{th} children at age t, X_{Mt} is the median weight and σ_{Mt} is the standard deviation of weight for children of age t in the reference populations –

typically the U.S. population. Children falling below two standard deviations from the reference median weight-for-age are malnourished and are severely malnourished if the deviation exceeds three or more.

3.3. Estimation Strategy

3.3.1. Determinants of Antenatal Care

The 1996 and 2001 NFHS do not sample the same households, thus preventing us from estimating panel models. Instead, we run cross-sectional models in two different data points and thereby subject our analysis to sample and time variations. In particular, using sample information from 1996 and 2001, we estimate Multinomial Logit, Ordered Logit, and OLS models to help explain variations in the qualitative dimension of antenatal care (i.e. the types of antenatal care) and Negative Bi-nomial model to help explain variations in the quantitative dimensions of antenatal care (the number of visits to antenatal care providers).

When mothers' choice of antenatal care is operationalized as a mere choice among professional, traditional or no care, antenatal care become a mutually exclusive categorical variable with no rank order underpinning the responses, we estimate a Multinomial Logit Model. However, we further treat choices of antenatal care as rank-ordered in regards to how professional/modern mothers' antenatal care service was (Professional – modern, traditional – less modern, none – not modern at all), and we estimate an Ordered Logit model. Finally, we estimate an OLS model to capture the variability in how many different types of antenatal care services a mother has sought while pregnant. Table 1 lists the estimation strategies we adopted based on the different ways we have conceptualized mothers' choices of antenatal.

Table 1: Conceptualizations of antenatal care and the estimation strategies

Conceptualization	Categories	Estimation Strategies
Type of antenatal care	Professional Traditional None	Multinomial Logit
Type of antenatal care	Modern (if professional) Less Modern (if traditional) Not Modern (if none)	Ordered Logit
Type of antenatal care	Number of Different types of care	Ordinary Least Squares
Frequency of seeking antenatal care	Frequencies (ranging from 0 – 7)	Negative Binomial

Nonetheless, we primarily report the Multinomial Logit results for the obvious reason that the choice of antenatal care is measured in a nominal level, and use the results deriving from alternative estimation techniques to check its robustness to alternative operationalization and estimations.

We expect mothers' decision to seek antenatal care on a regular basis to vary significantly with her and her husband's education, and exposure to information. In order to establish their independent effects on decisions to seek antenatal care, our model controls for mothers' age, history of pregnancy, place of residence, and religion since the previous studies find them significantly determining mothers' decision to seek antenatal care. For example, mothers intend to seek low or absolutely no antenatal care if they are relatively older and have given births before in India (Chandrashekar et al., 1998; Neilson, Liljestrand, Thilsted, Joseph, & Hedegaard, 2001). Women with high order pregnancies (i.e. large number of children) are less likely to seek antenatal care, as is also

the practice among pregnant mothers in Jordan (Obermeyer and Potter, 1991) and Kenya (Magadi et al., 2000). Additionally, in Nepal, religion and caste are no less important than socio-economic variables, as culture provides the overall justifications behind the beliefs and practices associated with pregnancy.[11] Finally, in order for mothers to utilize antenatal care, services must be accessible and available in the communities. Utilization of antenatal care is likely to be inversely affected if the health facilities are distantly located; it becomes a key constraint especially in rural areas in Nepal where supply of transportation is low, its cost is relatively high, and pregnant women might be discouraged from seeking antenatal care services if walking is the only way to get there.[12]

[11] The World Health Organization's (2005) report on Nepal reveals that, "..the cultural and religious practices during menstruation and childbirth often prevent women from accessing and utilizing essential health care services and thereby increase maternal, newborn and child mortality. Menstruation, childbirth and the 10 days after childbirth are considered to be impure and during those periods, the women are secluded from the family members and are sometimes kept in unhygienic places, such as cow sheds" (p. 63).

[12] Previous studies find that the quality matters as much, if not more, as the quantity (i.e. the physical availability) of health care services in explaining utilization of antenatal care. Lack of medical supplies and technical know-how among the attendants, and poor health management limit the benefits of seeking health services when services may be accessible and affordable in developing countries (Sundari, 1992; Acharya and Cleland, 2000; MotherCare, 1997).

We assume mothers' observed choices of antenatal care as manifestations of *latent* propensities to seek professional, traditional, or no care, and estimate the following equation.

$$Y_i^* = \beta' Z_i + \mu_i \quad (1)$$

Here Y^* is the log-odds ratio[13] of choosing professional or traditional care over none. Y_i takes the value of:

$Y_1 = 1$ if the log-odds ratio of choosing traditional antenatal care $Y_1^* > 0$, 0 elsewhere

$Y_2 = 1$ if the log-odds ratio of choosing traditional antenatal care $Y_2^* > 0$, 0 elsewhere

And,

$$\beta' Z_i = \beta_0 + \sum_{k=1}^{K} \beta_{Mk} M_{ki} + \beta_F F_i + \beta_U U_i \quad (2)$$

Where, *M*s comprise mothers' education, exposure to information, age, number of children under five years, if she currently works, and her religion; *F* is fathers' education and *U* is whether mothers live in an urban or a rural community. We hypothesize the magnitude of the coefficients for mothers' education, exposure to mass media, and fathers' education to be significantly greater than zero. As such,

Hypothesis 1 $\beta_{M1} > 0$, mothers' education affects choices to seek antenatal care

Hypothesis 2 $\beta_{M2} > 0$, mothers' exposure to media affects choices to seek antenatal care

Hypothesis 3 $\beta_F > 0$, fathers' education affects mothers' choices to seek antenatal care

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[13] A log-odds ratio transformation can be detailed as:

$\ln\left[\frac{\Pr ob(Y_i = j)}{\Pr ob(Y_i = 0)}\right] = \beta' Z_i + \mu_i$, where $\Pr ob(Y_i = j) = \frac{e^{\beta' Z_{ij}}}{\sum_{j=0}^{2} e^{\beta' Z_{ij}}}$ and $\Pr ob(Y_i = 0) = \frac{1}{1 + \sum_{j=0}^{2} e^{\beta' Z_{ij}}}$

We further operationalize choices of antenatal care as rank-ordered in regards to how professional/modern mothers' antenatal care service was (professional – modern, traditional – less modern, none – not modern at all), and we estimate an Ordered Logit model. Finally, we estimate an OLS model to capture the variability in how many different types of antenatal care services a mother has sought while pregnant. Nonetheless, we primarily report the Multinomial Logit results for the obvious reason that the choice of antenatal care is measured in a nominal level, and use the results deriving from alternative estimation techniques to check its robustness.

Next, we estimate the following Negative Binomial model. This seems appropriate to help explain variations in frequency to visit antenatal care providers since sample responses are counts and contain a disproportionately large number of zeros, thus resulting in over-dispersion.

The antenatal visit variable Y is assumed to follow the negative binomial distribution with

$\Pr ob(Y_i = y) = \frac{\Gamma(\theta + y)}{y\Gamma(\theta)} \frac{\mu_i^{y_i} \theta^{\theta}}{(\mu_i + \theta)^{\theta + y_i}}$, where θ is a random parameter that follows the Gamma Distribution. The mean of the dependent variable is associated with the explanatory variables through the link function, $\mu_i = e^{\beta' Z_i}$, where

$$\beta' Z_i = \beta_0 + \sum_{k=1}^{K} \beta_{kM} M_{ki} + \beta_F F_i + \beta_U U_i \qquad (3)$$

Our analysis, however, may have not eliminated heterogeneity biases ((Rosenzweig and Schultz, 1983) entirely.[14] Our use of survey data prevents from getting comprehensive information about mothers health heterogeneity. In particular, we do not observe whether a mother demands antenatal care because she previously has experienced birth complications and may be anticipating similar complications in the current period (i.e., adverse self-selection) or her demand for a particular type of antenatal care might result from her strong preferences for a healthy child (i.e. favorable self-selection) (Maitra, 2004). Our control for the number of children under five might captures mothers' unique health heterogeneity i.e. unique medical conditions, and should help us estimate the treatment effects of education and exposure to information on choices to seek antenatal care.

[14] Berhman and Deolalikar (1988) reviewed in total of four complications commonly considered in estimating the effects on child health. The prime cause underlying these biases may be the presence of exogenous health factors known to individual households but unobserved by the researcher (Rosenzweig and Schultz, 1983), and are unreported in the survey data. Simultaneity bias results when certain right hand side variables are treated as exogenous, whereas in reality they might be jointly determined with child health (Behrman and Deolalikar, 1988). In the study of health, the heterogeneity bias, more pertinent to this study, emerges when researchers ignore that exogenous health heterogeneity (mothers' overall reproductive health) may explain the interdependence of the levels of health inputs (e.g. utilization of antenatal care) and preference orderings (whether to seek antenatal care).

3.3.2. Determinant of Child Health

Our measure of child health is a standardized z value – a continuous random variable ranging from negative to positive; OLS seems appropriate to test how mothers' antenatal care seeking behavior affects child health. We, however, have utilized the predicted values of the choices of antenatal care[15] and the counts of the visits to antenatal care providers as deriving from the first stage analysis. We control for a vector of child, mother, father, household and community level variables. We estimate the following model using 1996 and 2001 data:

$$CHILDHEALTH_i = \beta_0 + \sum_{m=1}^{M} \beta_{Cm} C_{mi} + \sum_{k=1}^{K} \beta_{Mk} M_{ki} + \beta_F F_i + \sum_{l=1}^{L} \beta_{Hl} H_{li} + \beta_j U_i + \varepsilon_i \qquad (4)$$

Where, *C*s are child specific proximate variables (whether vaccinated, whether suffered from fever, cough, diarrhea in two weeks before the survey)[16] and non-proximate variables (gender, age, are-squared, birth order), *M*s are mother specific variables (mothers' height, weight, current age, age at marriage, number of dependent kids, religion, caste), *F* is father's age), and *H*s are household specific variables (sanitation --

[15] In explaining child health, past studies used variables as exogenous, whereas theoretically they are endogenous, such as mothers' decisions to undertake antenatal care. And estimating their effect on child health while treating them as exogenous along with other exogenous variables in the same equation might result in biased, quite misleading coefficient estimates (Strauss, 1990).

[16] Epidemiology research makes a distinction between proximate and non-proximate, such as socio-economic determinants of child health. Proximate variables are those having immediate affect on child health, such as child vaccination.

water supply and toilet facilities), and finally U is the community attribute (urban or rural). Following hypothesis 4, we expect mothers' antenatal care to have a significantly positive affect on child health, $\beta_{M1} > 0$. Researchers, like us, do not necessarily observe family backgrounds from surveys (Strauss, 1990), and ignoring family background variables could lead to biased estimates (Wolfe and Behrman, 1987). We control for mother's height as we expect height to capture the genetic as well as the un-observed family-specific effects on child health. Our analysis might have not completely rule out the limitations that usually follow survey data. Nonetheless, the results are suggestive.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

Malnutrition seems to prevail among children 0-36 months old in Nepal in 1996, and does not really improve in 2001. The majority of the children weigh nearly 2 standard deviations less than the average weight of the equal age group in the reference population. The sample includes almost an equal number of male and female children averaging 17 months both in 1996 and 2001. More than 75% of the children in both years suffered from fever, cough, or diarrhea within the last two weeks from the date of the interview. The percentage of children vaccinated appears to improve at an impressive rate within a five year interval in Nepal; 93% of the sampled children in Nepal in 2001 were vaccinated as opposed to 64% in 1996.

Only 44% of the mothers report to seek antenatal care, regardless of the type of care, in 1996, and 50% in 2001. This increase is because more mothers report seeking traditional antenatal care in 2001 (18% in1996 to 23% in 2001); however, there seems to be no major change in the number of mothers seeking professional antenatal care within this five year interval (26% in 1996 to 27% in 2001). On average, mothers report visiting antenatal care services once.

Teenage marriage is common in Nepal. The majority of the mothers report being married by 16 years of age. Not surprisingly, maternal educational achievement is quite low. In 1996, an alarming 88% of the mothers report no formal education; only 1% attended and completed primary school and less then 1% had a secondary or high school education. The level of maternal education did not improve in 2001; 14% of the mothers report a primary education, 1% a secondary education and less than 1% higher education.

Table 2: Descriptive statistics

Variables	Descriptions of the variables	1996			2001		
		Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Dependent Variable	Standardized weight for age	3732	-1.872	1.155	3660	-1.820	1.099
Antenatal Care Variables	Numbers of different professionals mother uses for previous prenatal care	4022	0.483	0.604	3404	0.657	0.772
	Did mother see doctor or nurse for previous prenatal care? Yes=1	4022	0.256	0.436	3788	0.265	0.441
	Did mother see midwife or other health worker for previous prenatal care? Yes=1	4022	0.178	0.382	3788	0.227	0.419
	Did mother see any professional for previous prenatal care? Doctor/nurse=2, midwife/FPworker=1, rest=0	4022	0.682	0.854	3788	0.710	0.857
	Number of antenatal visits for pregnancy	4009	1.239	2.032	3402	1.582	2.123
Children's attributes	Child alive or not? Yes=1	4097	1	0	3788	1	0
	Weight in kilograms	4009	8.168	2.325	3768	8.247	2.269
	Height in centimeters	3813	72.007	9.549	3736	72.828	9.772
	Age in months	4097	17.303	10.237	3788	17.417	10.213
	Age square	4097	404.18	372.42	3788	407.61	369.79
	Child is male or female? Male=1	4097	0.513	0.500	3788	0.487	0.500
	Child height is measured lying or standing? Standing=1	3808	0.295	0.456	3735	0.313	0.464
	Child birth order	4097	3.379	2.237	3788	3.200	2.129
	Child had diarrhea recently? Yes=1	4083	0.288	0.453	3783	0.253	0.435
	Child had fever or cough in last two weeks? Yes=1	3409	0.487	0.500	3788	0.524	0.499
	Child ever had vaccination? Yes=1	3178	0.643	0.479	2937	0.927	0.261

Table 2: Descriptive statistics (cont.)							
Mothers' Attributes	Mother's current age in years	4097	26.866	6.381	3788	26.706	6.186
	Mother's age at first marriage	4097	16.250	2.897	3788	16.711	2.726
	Log of mother's weight in kilograms	4043	3.810	0.126	3781	3.813	0.131
	Log of mother's height in centimeters	4035	5.013	0.036	3780	5.012	0.035
	Mother's education level. Primary=1, no education=base	4097	0.112	0.315	3788	0.142	0.349
	Mother's education level. Secondary=1	4097	0.082	0.274	3788	0.121	0.326
	Mother's education level. Above secondary=1	4097	0.012	0.110	3788	0.014	0.116
	Mother currently works. Yes=1	4089	0.776	0.417	3788	0.828	0.377
	Mother watches television at least once a week	4090	0.085	0.279	3788	0.172	0.377
Fathers' attributes	Father's age in years	4059	31.479	8.253	3754	31.004	7.769
	Father's education level. Primary=1	4090	0.254	0.435	3712	0.259	0.438
	Father's education level. Secondary=1	4090	0.279	0.449	3712	0.341	0.474
	Father's education level. Above secondary=1	4090	0.093	0.290	3712	0.061	0.239
Households' Attributes	Number of children under age 5	4097	2.053	1.122	3788	1.968	1.005
	Household has radio or not? Yes=1	4089	0.390	0.488	3788	0.408	0.492
	Home floor material. Earth, mud, dung=1, rest=0	4092	0.928	0.259	3788	0.843	0.364
	Drinking water source from tap? Yes=1.	4085	0.320	0.467	3535	0.345	0.475
	Drinking water source from well? Yes=1.	4085	0.064	0.245	3535	0.045	0.207
	Drinking water source inside residence? Yes=1.	4085	0.260	0.439	3535	0.296	0.456
	Type of toilet facility. No facility=0	4092	0.150	0.357	3536	0.240	0.427
	Type of toilet facility. Flush=1.	4092	0.016	0.125	3536	0.077	0.267
	Type of toilet facility. pit=1	4092	0.134	0.340	3536	0.163	0.369
Cultural Attributes	Religion. Hindu=1	4093	0.861	0.346	3788	0.843	0.364
	Caste. Chhetri=1	4097	0.201	0.401	3788	0.202	0.402
	Caste. Newar=1	4097	0.048	0.213	3788	0.038	0.191
	Caste. Brahmin=1	4097	0.118	0.323	3788	0.092	0.289

Table 2: Descriptive statistics (cont.)							
Regional Location Character	Type of place of residence. Urban=1	4097	0.089	0.285	3788	0.089	0.284
	Ecological region. Mountain=1. Terai=base	4097	0.137	0.344	3788	0.145	0.352
	Ecological region. hill=1	4097	0.419	0.493	3788	0.369	0.482
	Region. Eastern=1. Farwestern=base	4097	0.188	0.391	3788	0.228	0.419
	Region. Central=1.	4097	0.292	0.455	3788	0.280	0.449
	Region. Western=1.	4097	0.192	0.394	3788	0.157	0.364
	Region. Midwestern=1.	4097	0.178	0.382	3788	0.138	0.345
	Region. Farwestern=1.	4097	0.151	0.358	3788	0.197	0.398

This indicates that majority of women never progress basic education in Nepal. 78% of the mothers in 1996 and 83% in 2001 report working outside the home. Nearly 2% of the mothers report to watch television at least once a week in 2001. Paternal education, in addition, appears to be relatively low in Nepal; 25% of the fathers report to have completed primary schooling in 1996 and 2001, 27% and 34% report to have completed secondary schooling in 1996 and 2001 respectively, and only about 1% report to have education beyond secondary level in both years.

The NFHS further reports that 40% of the households own a radio in 1996 and 2001. 84% of the households' floors are made out of earth, mud, or dung in 2001 as opposed to 93% of the households in 1996. 32% of respondents report drinking water from the tap in 1996, and 34% in 2001. Only 15% of the respondents report having toilet facilities inside the households in 1996 as opposed to 24% in 2001. The respondents in the rural areas (91%) are over-represented in the sample both in 1996 and 2001. More than half of the respondents live in mountain or hill ecological regions in Nepal. The survey further reports that 86% and 84% of the respondents are Hindus in 1996 and 2001 respectively, although 36% of them report to be members of relatively superior castes – Brahmins, Chhetri or Newar in 1996, and 33% in 2001.

4.2. Regression Results

4.2.1. Determinants of Antenatal Care

The results presented in Table 2 seem to provide reasonable support to the hypotheses we set out to test about the determinants of decisions to seek antenatal care (hypothesis 1-3). Although education, especially mothers' education, we predict to significantly affect her decisions (hypothesis 1), we seem not to find a strict linear association between education and her decisions to seek a particular type of antenatal care (a and b of Column 1); the results are interesting in its own right, however. In particular, compared to those with no literacy, (a) mothers who completed a primary level of education are statistically indifferent in regards to seeking traditional antenatal care but are more likely to seek professional care, (b) mothers who completed secondary level of education are more likely to seek both traditional and professional antenatal care, and finally (c) mothers who completed higher secondary level education and above are less likely to seek traditional care and more likely to seek professional care. [17] When it comes to fathers' education, compared to those with no literacy, fathers who completed varying degree of education (primary, secondary or higher) are more likely to seek professional antenatal care for their wives. Mothers *and* fathers' education significantly explain her decisions about seeking antenatal care, and we thus find support for hypothesis 3 that fathers' education

[17] In the context of Nepal, primary education comprises of schooling up to the 5th grade (1– 5), lower secondary comprises of grades 6 – 8, higher secondary grades 9-10. Students sit for a national level School Leaving Certificate (SLC) Examination at the end of grade ten. Grades 11 and 12 are considered as higher secondary level.

Table 3: The determinants of seeking antenatal care in 1996

	(1)		(2)		(3)	(4)	(5)
	(a) Multinomial Logit (Traditional vs. none)	(b) Multinomial Logit (Professional vs. none)	(a) Multinomial Logit (Traditional vs. none)	(b) Multinomial Logit (Professional vs. none)	Ordered Logit (Rank order of Antenatal care)	OLS (Antenatal care index)	Negative Binomial (Frequency of seeking antenatal care)
Number of children	-.08 (-1.84)*	-.13 (-2.87)***	-.11 (-2.66)***	-.15 (-3.29)***	-.11 (-3.14)***	-.031 (-3.49)***	-.06 (-2.34)***
Mothers'_age	-.03 (-2.88)***	-.04 (-3.12)***	-.02 (-2.02)**	-.04 (-2.59)***	-.03 (-3.62)***	-.008 (-3.33)***	-.03 (-3.82)***
Mothers'_work	-.21 (-1.74)*	-.31 (-2.75)***	.27 (2.12)**	-.16 (-1.32)	-.26 (-3.00)***	-.067 (-2.67)***	-.11 (-1.83)*
Mothers'_primary	.07 (0.42)	.68 (5.01)***	-.03 (-0.16)	.60 (4.32)***	.51 (4.36)***	.139 (4.00)***	.25 (3.58)***
Mothers'_secondary	.82 (3.58)***	1.41 (7.65)***	.72 (2.92)***	1.35 (7.08)***	1.20 (7.98)***	.359 (8.16)***	.60 (7.86)***
Mothers'_higher	-30.41 (-29.25)***	3.51 (3.28)***	-28.28 (-27.54)***	3.64 (3.48)***	3.90 (3.64)***	.507 (5.39)***	.89 (7.38)***
Radio	.06 (0.60)***	.39 (4.11)***	.13 (1.27)	.46 (4.67)***	.26 (3.46)***	.071 (3.37)***	.23 (4.35)***
Mothers'-watch_tv_weekly	-.87 (-2.59)***	.50 (2.89)***	-1.17 (-3.40)***	.40 (2.22)**	.52 (2.97)***	.092 (2.04)**	.24 (2.76)***
Fathers'_age	.01 (1.35)	.00 (0.46)	.01 (0.82)	-.00 (-0.06)	.01 (0.83)	.002 (0.91)	.01 (1.43)
Fathers'_primary	-.06 (-0.49)	.56 (4.45)***	.10 (0.80)	.60 (4.72)***	.26 (2.86)***	.055 (2.20)**	.22 (3.04)***
Fathers'_secondary	.39 (3.03)***	.86 (6.54)***	.48 (3.57)***	.85 (6.38)***	.59 (6.15)***	.142 (5.11)***	.46 (6.54)***
Fathers'_higher	.22 (1.13)	.60 (3.25)***	.20 (1.00)	.53 (2.84)***	.38 (2.67)***	.112 (2.78)***	.39 (4.10)***
Hindu	.37 (2.53)**	-.12 (-.83)	.35 (2.29)**	-.19 (-1.27)	.07 (0.66)	.020 (0.71)	.09 (1.08)
Chhetri	-.24 (-2.01)**	.14 (1.13)	.52 (3.67)***	.61 (4.27)***	-.02 (-0.21)	-.016 (-0.66)	-.04 (-.053)
Newar	-.12 (-0.42)	.95 (4.73)***	.22 (0.74)	1.28 (5.92)***	.69 (3.81)***	.111 (2.51)**	.53 (5.28)***
Brahmin	-.17 (-0.97)	.74 (5.17)***	.30 (1.63)	.98 (6.42)***	.50 (4.17)***	.112 (3.21)***	.28 (3.94)***
Urban	-2.50 (-4.24)***	.91 (5.65)***	-2.23 (-3.73)***	.67 (5.75)***	.78 (4.66)***	.074 (1.87)*	.26 (3.24)***
Mountain	-	-	-1.43 (-8.00)***	-.59 (-3.75)***	-	-	-
Hill	-	-	-.99 (-8.93)***	-.68 (-5.94)***	-	-	-
Eastern	-	-	1.71 (7.73)***	.13 (0.76)	-	-	-
Central	-	-	1.93 (8.99)***	.19 (1.21)	-	-	-
Western	-	-	1.72 (7.82)***	.66 (4.16)***	-	-	-
Midwestern	-	-	1.49 (6.86)***	-.34 (-2.04)***	-	-	-
Constant	-.58 (-1.97)**	-.51 (-1.69)*	-2.35 (-6.34)***	-.49 (-1.47)	-	.592 (9.46)***	.21 (1.24)
N	3967	3967	3967	3967	3967	3967	3954
Pseudo R^2	0.1255	0.1255	0.1572	0.1572	0.1024	-	-
Log-likelihood ratio	-3428.77	-3428.77	-3304.36	-3304.36	-3519.36	-	-5610.62
R^2	-	-	-	-	-	0.1418	
Alpha	-	-	-	-	-		1.3240*** [1425.05]

***p<0.01, **p<0.05, **p<0.10

Note: Values in parentheses ( ) are Z-values in Logit and Negative Binomial Model, and t-values in the OLS model. The value in bracket [ ] in model 5 is the likelihood ratio test value for alpha=0.

should matter for mothers seeking antenatal care. Finally, we expect mothers who are more exposed to information via mass-media should be more likely to seek antenatal care (hypothesis 2). Our findings suggest that mothers who watch television at least once a week are less likely to seek traditional care and more likely to seek professional care. Additionally, mothers who have radios in the household are more likely to seek traditional or professional antenatal care over no care, whereas those watching television at least once a week are less likely to seek traditional care and more likely to seek professional care.[18]

Column 1 of Table 2 further shows that relatively younger mothers with fewer children at home (little or no experience with pregnancy) are more likely to seek antenatal care. Fathers' age seems not to play a role in mothers' antenatal care seeking decisions. We additionally find that Hindu mothers are more likely to seek traditional antenatal care but are indifferent to professional care compared to non-Hindu

[18] The significance of information even when education is controlled indicates that even when education is the same, those with better exposure to information are more likely to seek antenatal care. Despite Caldwell's (1979) contention that female education emancipates her from the social and cultural constraints against seeking antenatal care, debates prevails about the exact mechanisms by which education affects antenatal care seeking behavior. Studies rather emphasize on the positive externalities that education brings; such as, education provides with, among others, the information about basic cleanliness, which helps maintain good health. When information about cleanliness is disseminated through mass media, mothers get the basic health information even when they might have not attended to schools.

counterparts. Compared to those mothers belonging to lower castes, *Chhetri* mothers are less likely to seek traditional care although relatively superior castes, such as *Newar* or *Brahmins* do not seem to differ from their inferior caste counterparts in regards to seeking traditional antenatal care over seeking no care. Overall, this study could not establish a clear pattern between cultural denomination – religion or caste (among Hindus) – and antenatal care seeking behavior. Consistent with prior studies, we find that compared to mothers residing in rural areas, those in urban areas are less likely to seek traditional antenatal care and more likely to seek professional care. Column 2 presents the result when we further control for regional variations. The results evident in Column 1, however, remain unchanged to regional variations. We also find that compared to mothers living in *terai* (plain), those live in mountains or hills are less likely to seek professional antenatal care.

Column 3 and 4 of Table 2 present the results when we alternatively operationalize decisions to seek antenatal care as an ordered and a continuous outcome, and accordingly estimate Ordered Logit and OLS models. Our results remain consistent to alternative operationalizations of decisions to seek antenatal care variable and estimation strategies. In particular, the Ordered Logit results show that a higher level of education increases the likelihood of seeking modern antenatal care and mothers' education is as important as fathers' education in regards to seeking antenatal care (Column 3). All else equal, mothers who are more exposed to information through having a radio at home, or watching a television, report a higher likelihood of seeking antenatal care. Younger mothers and those who reside in urban areas are more likely to seek antenatal care than the older mothers.

What explains why every mother in Nepal doesn't visit antenatal care providers regularly? Our estimates using a Negative Binomial model show that mothers' education, age, access to information and availability of health care facilities in the community significantly explain how frequent they are in visiting antenatal care providers. Compared to illiterate mothers, mothers who completed primary, secondary or higher education are more frequent to seek antenatal care. Younger mothers, those who live in urban areas, and those with better access to information visit antenatal care providers more frequently. Furthermore, mothers who have better access to information, in forms of watching TV more frequently, or having a radio at home, visit health care providers more frequently.

Overall, the 1996 evidences provide reasonable bases to argue that fathers' in addition to mothers' education, exposure to information matter in order for mothers to seek antenatal care and seeking so on a regular basis, as we hypothesize. We further find that mothers' age, availability of health services in the community also play a role about mothers' decisions to seek antenatal care. We find support for the socio-economic determinants of seeking antenatal care in Nepal as prior studies suggested in the context of other developing countries. Yet this study endorses fathers' especially education as one of the key determinants.

The 1996 evidences seem to hold when we re-estimate the models with 2001 data (Table 3) in that mothers seem to seek professional antenatal care (Columns 1 – 4) and are regular to visit antenatal care providers (Column 5) if they are relatively educated, young, more exposed to mass-media, married to relatively educated husbands, and have fewer dependent children at home. Consistent to the estimates from the 1996 data, we find that compared to illiterate mothers, those who completed primary, secondary and

Table 4: Determinants of seeking antenatal care in 2001

	(1)		(2)		(3)	(4)	(5)
	(a) Mutlinomial Logit (Traditional vs. none)	(b) Multinomial Logit (Professional vs. none)	(a) Multinomial Logit (Traditional vs. none)	(b) Multinomial Logit (Professional vs. none)	Ordered Logit (Rank order of Antenatal care)	OLS (Antenatal care index)	Negative Binomial (Frequency of seeking antenatal care)
Number of children	-.21 (-4.24)***	-.28 (-4.97)***	-.22 (-4.22)***	-.30 (5.26)***	-.24 (-5.71)***	-.045 (-2.93)***	-.07 (-2.80)***
Mothers'_age	-.01 (-.40)	-.06 (-4.01)***	-.01 (-0.42)	-.06 (-4.02)***	-.04 (-3.37)***	-.010 (-2.73)***	-.02 (-3.15)***
Mothers'_work	-.20 (-1.39)	-.55 (-4.11)***	.06 (0.44)	-.40 (-2.86)***	-.45 (-4.36)***	-.136 (-3.16)***	-.28 (-4.71)***
Mothers'_primary	.48 (3.32)***	.72 (5.35)***	.46 (3.13)***	.68 (4.83)***	.61 (5.69)***	.175 (4.11)***	.40 (5.67)***
Mothers'_secondary	.73 (3.57)***	1.22 (7.10)***	.68 (3.29)***	1.11 (6.21)***	1.07 (7.61)***	.371 (6.70)***	.60 (8.96)***
Mothers'_higher	.80 (1.22)	1.28 (2.31)**	.70 (1.06)	1.11 (1.98)**	1.03 (2.41)**	.447 (3.15)***	.67 (5.06)***
Radio	.16 (1.58)	.13 (1.28)	.24 (2.27)**	.20 (1.91)*	.13 (1.60)	.022 (0.77)	.09 (1.73)*
Mothers'-watch_tv_weekly	.31 (1.90)*	.98 (7.31)***	.17 (1.02)	.81 (5.77)***	.83 (7.57)***	.306 (6.36)***	.42 (7.70)***
Fathers'_age	-.03 (-2.24)**	.03 (2.40)**	-.02 (-2.01)**	.03 (2.36)**	.01 (1.28)	-.001 (-0.49)	.00 (0.77)
Fathers'_primary	-.34 (-2.64)***	.23 (1.71)*	-.21 (-1.60)	.28 (1.98)**	.01 (0.09)	-.022 (-0.62)	-.02 (-0.26)
Fathers'_secondary	-.31 (-2.36)**	.52 (3.73)***	-.21 (-1.62)	.51 (3.60)***	.21 (2.09)**	.085 (2.17)**	.24 (3.47)***
Fathers'_higher	-.08 (-0.26)	1.16 (4.53)***	-.03 (-0.09)	1.16 (4.53)***	.77 (3.62)***	.247 (3.20)***	.46 (3.66)***
Hindu	.08 (0.57)	-.11 (-0.83)	.00 (0.03)	-.29 (-2.01)**	-.06 (-0.58)	.018 (0.49)	-.00 (-0.07)
Chhetri	-.31 (-2.22)**	-.03 (-0.23)	.21 (1.05)	.50 (3.26)***	-.11 (-1.09)	-.071 (-2.06)**	-.06 (-0.89)
Newar	.04 (0.16)	.29 (1.30)	.22 (0.81)	.60 (2.60)***	.22 (1.25)	.029 (0.44)	.21 (2.29)**
Brahmin	.26 (1.31)	.53 (3.00)***	.56 (2.69)***	.89 (4.77)***	.41 (2.86)***	.194 (3.55)***	.10 (1.41)
Urban	-.29 (-1.12)	1.00 (5.23)***	-.19 (-0.73)	1.12 (5.72)***	.96 (5.62)***	.112 (1.99)**	.30 (4.87)***
Mountain	-	-	-.50 (-3.38)***	-.94 (-5.56)***	-	-	-
Hill	-	-	-.58 (-4.83)***	-.66 (-5.42)***	-	-	-
Eastern	-	-	.71 (3.92)***	.22 (1.32)	-	-	-
Central	-	-	.93 (5.60)***	-.08 (0.50)	-	-	-
Western	-	-	.81 (4.43)***	.53 (3.09)***	-	-	-
Midwestern	-	-	.42 (2.36)**	-.51 (-3.00)***	-	-	-
Constant	.42 (1.33)	-.05 (-0.16)	-.38 (-1.05)	.18 (0.53)	-	.965 (11.07)***	.75 (4.58)***
N	3681	3681	3681	3681	3681	3306	3304
R^2	-	-	-	-	-	0.1877	-
Wald χ^2	584.24	584.24	701.79	701.79	571.23	-	1070.18
Pseudo R^2	0.1249	0.1249	0.1429	0.1429	0.1167	-	-
Log-likelihood ratio	-3196.4814	-3196.4814	-3130.9713	-3130.9713	-3226.75	-	-5316.30
Alpha	-	-	-	-	-	-	0.9575*** [1000.81]

***p<0.01, **p<0.05, **p<0.10

Note: Values in parentheses ( ) are Z-values in Logit and Negative Binomial Model, and t-values in the OLS model. The value in bracket [ ] in model 5 is the Likelihood ratio test value for alpha=0.

higher education are more likely to seek modern antenatal care according to the 2001 evidences. Mothers who watch television more frequently in any given week are more likely to seek antenatal care. Fathers' education seem to affect mothers' decisions to seek tradition or modern antenatal care in expected directions in 2001; as such, compared to illiterate fathers, those with primary, secondary and higher education are less likely to adopt traditional care and more likely to seek professional antenatal care for their wives. The results from 2001 data thus show that as long as fathers procure at least some education, they prefer modern care over traditional or no antenatal care for their pregnant wives.

The estimates from 2001 data also support the relationships between demographic variables – mothers' age and pregnancy history—and antenatal care seeking decisions. Younger mothers who are new to pregnancy are more likely to seek traditional or modern antenatal care over none. However, the results find that the cultural variables – religion or caste denomination – holding less consistent effects compared to socio-economic and demographic variables on mothers' antenatal care seeking behavior. The 2001 estimates, however, find no systematic difference between Hindu mothers with their non-Hindu counterparts or inferior and superior caste members in regards to antenatal care seeking behavior.

Overall, our analysis suggests that mothers' and fathers' education, exposure to mass-media (preferably health information), mothers' age, number of children, areas of residence are the key socio-economic and demographic determinants of whether mothers' utilize antenatal care, regardless of traditional or professional, as well as how frequent/regular she is to seek antenatal care. Consistent with prior studies, we find

education and exposure to information matter more for mothers to seek professional care on a regular interval. Our analysis further indicates that fathers' education is no less important than mothers' education in regards to seeking antenatal care, a finding which has not been widely endorsed in the prior studies. However, we argue that in the context of Nepal, the significance of fathers' education should be recognized as mothers' education may not necessarily bring her the level of status or autonomy or any meaningful decision making abilities needed to seek antenatal care.

4.2.2. Determinants of Child Health

Next, we test hypothesis 4 that mothers' antenatal care help children maintain good health using the data from 1996 (Column 1 – 4) and 2001 (Column 5 – 8) after controlling for the determinants commonly found in the child health literature (Table 4). However, our measure of antenatal care is the predicted, instead of the observed, values of antenatal care. In particular, column 1 and 2 report the result of OLS models, where the predicted values for the antenatal care, using, respectively, the Ordered logit and the Multinomial logit models, are employed to obtain the estimates of child health parameters. Column 3 reports the 3SLS estimates. Column 4 shows how the frequencies of seeking antenatal care, as predicted by the Negative Binomial model, affect child health.

Column 2 of Table 4 suggests that child health appears to be significantly affected by mothers' decisions to seek traditional or modern care. The results suggest that when mothers decide to choose professional antenatal care, their children have better health status in infant and toddler years; however, child health does not appear to be affected by mothers' seeking traditional care. The analysis thus suggests the while modern antenatal care enhances child health, traditional antenatal care appears to be indifferent, if not detrimental, to child health. We also find that vaccination affects child's current health status, but does so adversely. This seemingly anomalous finding may be capturing the immediate or short-term effects that vaccination might incur on child weight. Overall, when mothers seek especially professional antenatal care, children are more likely to be born with and maintain good health.

Table 5: Determinants of child health in 1996 and 2001 (Stage Two Weight IV Regression)

	1996				2001			
	(1) Fitted Ordered Logit	(2) Fitted Multinomial Logit	(3) 3SLS	(4) Fitted Negative Binomial	(5) Fitted Ordered Logit	(6) Fitted Multinomial Logit	(7) 3SLS	(8) Fitted Negative Binomial
Dep. Var.	Standardized weight for age				Standardized weight for age			
Instrumented Variables								
Ordered_antenatal_index	.225 (4.69)***	Traditional .003 (0.48) / Professional .206 (5.19)***	-	-	.193 (4.51)***	Traditional -.026 (-0.32) / Professional .163 (4.59)***	-	-
Antenatal_index	-	-	.652 (3.11)***	-	-	-	.410 (2.94)***	-
Number_ante_visits	-	-	-	.411 (5.11)***	-	-	-	.306 (4.28)***
Indep. Var.								
Children_standing	.335 (3.71)***	.338 (3.75)***	.350 (4.20)***	.288 (3.18)***	.324 (3.71)***	.313 (3.43)***	-.252 (2.90)***	.255 (2.97)***
Children's gender (1 if male)	.023 (0.55)	.020 (0.50)	.021 (0.52)	.039 (0.94)	.010 (0.27)	.011 (0.27)	.015 (0.39)	.019 (0.49)
Children_age	-.137 (-14.74)***	-.134 (-14.39)***	-.146 (-16.80)***	-.134 (-14.38)***	-.150 (-16.09)***	-.150 (-16.18)***	-.154 (-16.87)***	-.153 (-16.60)***
Children_age_sq	.002 (8.79)***	.002 (8.67)***	.003 (10.32)***	.002 (8.55)***	.003 (10.09)***	.003 (10.16)***	.003 (10.11)***	.003 (10.14)***
Children_birth-order	-.030 (-1.59)	-.027 (-1.43)	-.046 (-2.59)***	-.018 (-0.92)	-.010 (-0.55)	.020 (0.83)	-.024 (-1.32)	.004 (0.19)
Children_diarrhea	-.205 (-4.31)***	-.221 (4.64)***	-.193 (-4.09)***	-.147 (-3.01)***	-.110 (-2.43)**	-.098 (-2.16)**	-.098 (-2.21)**	-.109 (-2.41)**
Children_fever_cough	-.070 (-1.62)	-.061 (-1.39)	-.097 (-2.28)**	-.073 (-1.68)*	-.104 (-2.49)**	-.085 (-1.79)*	-.056 (-1.39)	-.109 (-2.57)***
Children_vaccinated	-.164 (-1.99)**	-.149 (-1.94)*	.150 (1.90)*	-.302 (-2.99)***	-.039 (-0.39)	.011 (0.11)	.045 (0.47)	-.043 (-0.44)
Number of children	.007 (0.34)	.014 (0.67)	.007 (0.32)	-.009 (-0.48)	-.022 (-0.84)	-.041 (-1.27)	-.065 (-2.62)***	-.065 (-2.80)***
Logged_mothers'_height	.682 (0.94)	1.156 (1.64)*	1.564 (2.25)**	.779 (1.09)	2.093 (3.19)***	2.431 (3.41)***	1.788 (2.91)***	1.828 (2.79)***
Logged_mothers'_weight	2.466 (11.45)***	2.32 (11.27)***	1.943 (8.83)***	2.416 (11.54)***	1.506 (7.47)***	1.438 (6.75)***	1.509 (8.98)***	1.425 (2.79)***
Mothers'_age	.013 (1.71)*	.013 (1.72)*	.014 (1.82)*	.015 (1.97)**	.006 (0.76)	-.001 (-0.07)	.006 (0.81)	.008 (0.95)
Mothers'_age_marriage	.016 (1.83)*	.015 (1.67)*	.018 (2.11)**	.020 (2.28)**	-.003 (-0.29)	.004 (0.34)	0.13 (1.34)	-.002 (-0.24)
Fathers'_age	-.001 (-0.13)	.000 (0.01)	.000 (0.05)	-.002 (-0.51)	-.002 (-0.34)	-.002 (-0.55)	.000 (0.01)	-.003 (-0.57)
Hindu	-.090 (-1.39)	-.060 (-0.92)	-.095 (-1.42)	-.076 (-1.18)	-.222 (-3.70)***	-.207 (-3.42)***	-.278 (-4.63)	-.211 (-3.52)***
Chhetri	-.150 (-2.74)***	-.188 (-3.37)***	-.140 (-2.27)**	-.161 (-2.93)***	.029 (0.60)	-.015 (-0.26)	.075 (1.38)	.032 (0.66)
Newar	.109 (1.02)	.084 (0.79)	.231 (1.88)*	.033 (0.30)	.269 (2.38)**	.262 (2.31)**	.223 (2.00)**	.271 (2.41)**
Brahmin	-.210 (-2.50)**	-.268 (-3.02)***	-.167 (-1.86)*	-.208 (-2.52)**	-.119 (-1.60)	-.137 (-1.83)*	-.044 (-0.56)	-.052 (-0.75)
Urban	-.050 (-0.51)	-.041 (-0.43)	.072 (0.64)	.015 (0.16)	-.189 (-1.89)*	-.197 (-1.88)*	-.100 (-0.98)	-.066 (-0.73)
Water_tap	.111 (2.35)**	.078 (1.66)*	.078 (1.61)	.119 (2.51)**	.053 (1.18)	.062 (1.37)	-.031 (-0.66)	.057 (1.25)
Water_well	-.010 (-0.11)	.006 (0.07)	.070 (0.86)	.006 (0.07)	.157 (1.66)*	.188 (1.94)*	.149 (1.59)	.116 (1.23)
Water_res	-.049 (0.57)	-.061 (-1.07)	.034 (0.59)	-.038 (-0.69)	-.063 (-1.19)	-.051 (-0.86)	.024 (0.44)	-.050 (-0.96)

Toilet	-.021 (-0.28)	-.039 (-0.52)	.103 (1.42)	-.020 (-0.27)	.043 (0.69)	.053 (0.77)	.133 (2.02)**	.030 (0.47)
floor	-.027 (-0.27)	-.055 (-0.54)	-.092 (-0.94)	-.032 (-0.32)	-.181 (-2.00)**	-.191 (-2.09)**	-.209 (-2.38)**	-.192 (-2.11)**
Constant	-15.405 (-4.78)***	-15.218 (-4.72)***	-16.514 (-5.39)***	-13.875 (-4.25)***	-14.256 (-4.84)***	-17.541 (-5.50)***	-15.186 (-5.38)***	-014.578 (-4.95)***
N	2358	2358	2318	2358	2554	2554	2249	2554
R^2	0.3072	0.3088	0.1933	0.3084	0.3045	0.3058	0.2730	0.3039

***p<0.01, **p<0.05, **p<0.10
Note: z-values are in parentheses in Logit models and t-values in the 3SLS model.

The negative coefficient of children's age indicates that as a child ages, its health status deteriorates in Nepal. This also suggests that child health maintains international standard for a few years after birth; but as they age past the threshold level, perhaps due to inadequate supply of nutrition in forms of food etc., they deviate more in the negative direction from the international health standard. Gender of a child seems not to affect its health outcomes during younger years (less than three). This may indicate that households are indifferent towards taking care of male or female children who are as young as three years or less. Recent outbreaks of health hazards, such as diarrhea, affect a child's current health for obvious reasons. Our study fails to find support for birth order as a significant predictor of child health (Haughton and Haughton, 1997).

Mothers' weight and height are important predictors of child health. In absence of information about mothers' unique health conditions, mothers' weight may be a gross indicator of mothers' current health status, and the results indicate that healthy children are more likely to be born to, and nurtured by mothers who maintain good health. If we assume height to be a function of genetic as well as the proper supply of food and nutrition, mothers height may capture how well a mother was nurtured in her own family, thus capturing her parents' attitudes to her physical upbringing. Mothers' height is a genetic attribute; it might also capture unobserved (to researchers) household heterogeneity, and thus provides a key control for estimating effects of the core variables or our interest on child health. We further find that when mothers get married at a relatively older age,[19] children maintains good health.

[19] Rosenzweig and Schultz (1983) treat mother's age as an endogenous (choice) variable, and instrumentalize it while estimating its effect on child health. However, in Nepal,

Since a child is more likely to lose weight while suffering from water-borne disease, we control for households' sources of water supply. Children appear to be healthier when they are raised into households who collect water from a tap instead of surface water. Households' sanitary conditions seem not to affect child health.

The 2001 evidences seem to show consistent results (Column 5-7 of Table 4). Regardless of which of Multinomial Logit, Ordered Logit or OLS model has helped predict the values of decisions to seek antenatal care, the 2001 estimates seem to suggest that mothers' decision to seek professional antenatal care affects her child's health in infant and toddler years. We further find considerable support for mothers' health (weight and height) conditions to have significant impact on child health. Healthy mothers seem to give birth to and raise healthy kids. Mothers' current age and the age she gets married at affect child health; mothers who get married at a relatively older age are more likely to have healthy children. Child health disparity seems not due to its gender differences; however, age seems to affect child health.

Mothers' frequent visits to antenatal care providers help explain child health in infant and toddler years (Column 4 and Column 8), and its effect is robust to time sample variations and when we control for the socio-economic and demographic determinants of child health. Mothers' weight is still significant as are the child specific variables – child's age, recent history of diseases, such as fever, cough. Modern child care, such as

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mother's age is more likely not to be a choice variable; marriages, especially in rural areas where most of our sample is drawn from, are arranged by parents.

vaccination, does not affect child health as the 2001 findings suggest. We argue that mothers' professional antenatal plays a key role for a child to be born with and maintain good health.

We further subject our analysis to two additional estimations (Column 1 and 3 of Table 4). Column 1 presents the second stage least square results, when the Ordered Logit model helped predict the values of antenatal care, and column 3 shows the three stage least squares (3SLS) results. While maintaining overall consistency, the 3SLS estimates, however indicate that birth order turns out to be a significant predictor of child health, indicating that the younger children are better nourished than the older children, and the direction is as is found in prior studies (Haughton and Haughton, 1997).

Table 6: List of the Hypotheses and Statistical Decisions

Hypothesis	Statistical Decisions about the Null Hypothesis (H_0)		Level of Confidence
	Reject	Fail to Reject	
1: *Educated mothers are more likely to utilize antenatal care than their non-educated counterparts.* H_0: $\beta_{mothers'education} = 0$ H_1: $\beta_{mothers'education} \neq 0$	√	×	95% - 99%
2. *Mothers are more likely to utilize antenatal care if they are exposed to media and, presumably, health information.* H_0: $\beta_{mothers'exposed\ to\ mass\ media} = 0$ H_1: $\beta_{mothers'exposed\ to\ mass\ media} \neq 0$	√	×	99%
3. *Mothers are more likely to utilize antenatal care if their husbands are more educated.* H_0: $\beta_{fathers'education} = 0$ H_1: $\beta_{fathers'education} \neq 0$	√	×	95% - 99%
4. *Children seem to maintain good health in infant and toddler years if their Mothers have sought, preferably professional, antenatal care, and this effect is robust to sample variations and alternative model specifications.* H_0: $\beta_{fathers'antenatal\ care} = 0$ H_1: $\beta_{fathers'antenatal\ care} \neq 0$	√	×	99%

5. CONCLUSION AND POLICY RECOMMENDATIONS

In this paper we seek to explain (1) why every mother in Nepal does not seek antenatal care on a regular basis during pregnancy, and (2) how mothers' antenatal care seeking behavior affects child health. Our analysis of the 1996 and 2001 Nepal Health and Demographic Survey data find that fathers' education is equally important, if not more, as mothers' education for her to utilize especially professional antenatal care on a regular interval and that mothers should take good care of her health regardless of being pregnant or not in order for her kids to maintain good health. Regardless of alternative operationalizations of the key variables and estimation techniques, we consistently find that education, exposure to information, mothers' age, number of children, areas of residence significantly determine whether mothers utilize professional antenatal care. When mothers are themselves healthy and seek professional antenatal care, they are more likely to give birth and raise healthy kids.

Our findings might offer key policy measures to improve maternal and child health in Nepal. We suggest increasing awareness about maternal health and its roles in improving child health ideally through education and/or dissemination of information via mass media. We further argue that education helps women make decisions about her and child health; however, we are being a little too optimistic about female education and its role in bringing autonomy to her life almost *readily* in developing countries. In bringing about meaningful improvement in women's social status, education works but does so only in the right social context (Caldwell, 1986). We emphasize that the father and, in the context of extended family structure in Nepal, other family members (mother-in-laws, sister-in-laws etc.) ought to be aware of the relevance of mothers' health for child health,

and support her in that a mother maintains good health and seeks care especially when they are pregnant to improve her and child's health in Nepal.

Based on our findings, we recommend the following policy measures:

- Making professional antenatal care Accessible in the community
- Raising awareness about the primacy of mothers' health care in securing child health
- Raising awareness about mothers' overall health
- Disseminating health information.

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